

Databases
IGCSE Computer Science • Topic 9

IGCSE Computer Science

Databases
What we will cover

1

Tables, records & fields

2

Data types for fields

3

The primary key

4

Validation

5

SQL

6

Recap

1
Structure

Databases
Structure

Records and fields

field (a column)

record (a row)

StudentID	First Name	Date of Birth	Form Class	Fees Paid
1	Amy	14/03/2009	10A	TRUE
2	Ben	02/11/2008	10B	FALSE

primary key (unique)

■ A **record** 记录 is one row in the table – all the data about one thing (for example one student).

■ A **field** 字段 is one column in the table – one piece of data that every record has (for example "First name").

Databases
Structure

Field data types

text
number
date/time
boolean

a name
an age
a birthday
yes / no

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Databases
Structure

The field data types

text/alphanumeric 文本 letters, digits and symbols – 10A, Amy

integer 整数 a whole number – 42

real 实数 a number with a decimal point – 3.5

Boolean 布尔 two states only – TRUE/FALSE, or Yes/No

date/time 日期时间 stored as a date so it can be sorted and compared correctly

the trap a phone number is **text**, not an integer – it may start with a zero, and you never do arithmetic on it

Pick the type by what you will do with the field, not by what it looks like. That is the single most-tested judgement in this topic.

The primary key

A **primary key** 主键 is the field that **uniquely** identifies each record – no two rows share it.

- a StudentID, an ISBN, an order number
- never blank, never repeated

A name is a **poor** key – two people share "Li Wei". The key must be something guaranteed unique, which is why databases invent an ID field.

2 Checking and querying

Validation in a database

age field: range check 0–120
enter 16 → accepted
enter 200 → rejected

The database can **reject** bad data as it is entered:

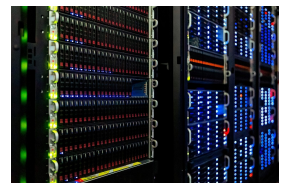
- **range** 范围 – a mark 0–100
- **type** 类型 – a number, not letters
- **presence** 存在性 – not left blank
- **format** 格式 – a date as dd/mm/yyyy

Validation stops **impossible** data at the door – but it cannot tell whether a *valid* value is the *right* one.

What is a database?



A library card catalogue is a database on paper – records you can search and sort by index



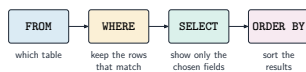
Large modern databases are stored on servers in data centres

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Structured Query Language

SQL 结构化查询语言 asks a database questions:

SELECT ... FROM ... WHERE ...



- SELECT the fields (columns)
- FROM the table
- WHERE a condition is met
- ORDER BY to sort

Read it in that order: pick columns, from a table, keeping only rows the WHERE allows.

Working out the output

To find the output of an SQL script, read it in this order:

WHERE – keep only the records that match the condition; 3.

Databases
└ Checking and querying

Worked example – a query

List the name and mark of every student who scored above 80, best first.

```
SELECT Name, Mark
FROM Students
WHERE Mark > 80
ORDER BY Mark DESC
```

WHERE filters *rows*; SELECT picks *columns*. DESC sorts high-to-low – leave it off and you get low-to-high.

Databases
└ Checking and querying

SELECT picks fields

```
SELECT name
FROM students
WHERE age > 15
```

gets the names of students older than 15

SELECT picks fields, FROM names the table, WHERE sets the condition

Reading a SELECT query

SELECT

which fields (columns) to show

FROM

which table to take them from

WHERE

which records (rows) to include – the condition

ORDER BY

how to sort the result, ascending or descending

reading one

SELECT FirstName, Class FROM Students WHERE Paid = TRUE shows the first name and class of every student who has paid the fees

the order

work out FROM, then WHERE, then SELECT – rows first, columns second

SELECT chooses *columns*; WHERE chooses *rows*. Every query question is answered by keeping those two jobs apart.

Building a query in reading order

the order to build it

FROM names the table, WHERE keeps only the matching records, SELECT then chooses the fields

AND

both conditions must be true

OR

at least one must be true

a worked query

a Book table with Title, Author, Price, InStock

the statement

SELECT Title, Price FROM Book WHERE Price < 10 AND InStock = TRUE;

a single-table database 单表数据库

all the fields in one table – what the IGCSE paper always uses

Build FROM, then WHERE, then SELECT, even though you write them in the other order. Rows first, columns second.

Databases
└ Checking and querying

Exam tips

- A **record** is a row (all the data about one thing); a **field** is a column (one item that every record has).
- A **primary key** must be *unique* for every record, so it picks out exactly one record (StudentID, not FormClass).
- Learn the SQL parts: SELECT (which fields), FROM (which table), WHERE (the condition), ORDER BY (sort, ASC or DESC).
- Read a query in the order **FROM** → **WHERE** → **SELECT** → **ORDER BY** to work out its output.
- COUNT counts the matching records; SUM adds up a number field.

3

Recap

Topic 9 – key takeaways

1 Structure

record = row (item); field = column (attribute)

3 Validation

range, type, presence, format at entry

2 Key

primary key uniquely identifies each record

4 SQL

SELECT columns FROM table
WHERE rows

Check yourself

- 1 Is a record a row or a column?
- 2 Why is a name a poor primary key?
- 3 Which SQL clause filters rows?
- 4 Best data type for a phone number?

Answers 1. a row 2. names repeat 3. WHERE 4. TEXT